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Serious psychological distress and health outcomes for persons with epilepsy in poverty

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ABSTRACT

Epidemiology literature demonstrates socioeconomic status as an important variable for outcomes in persons with epilepsy. However, no previous studies have analyzed the association between poverty and epilepsy in the United States. Forty-one percent (246/604) of persons with a history of epilepsy (PWHE) in the 2005 California Health Interview Survey (n = 43,020) had an annual income <200% Federal Poverty Level (FPL), adjusted lifetime prevalence rate 0.5% [98.33% CI 0.4–0.7]. Four groups are presented in the analyses: (1) those with a history of epilepsy <200% FPL, (2) those with a history of epilepsy ≥200% FPL, (3) those not reporting a history of epilepsy <200% FPL and (4) those not reporting a history of epilepsy ≥200% FPL. PWHE in poverty reported significantly higher amounts of serious psychological distress, based on the validated Kessler 6 (K6) scale, than both non-epilepsy populations. After adjusting for demographics and other comorbid conditions, logistic regression analyses show PWHE in poverty are significantly more likely to report fair or poor self-rated health status when compared to the PWHE not in poverty and both non-epilepsy populations. PWHE in poverty are also more likely to report ≥14 generally unhealthy days and ≥14 physically unhealthy days in the past 30 days compared to the PWHE not in poverty and both non-epilepsy populations. Psychological well-being needs to be incorporated into any comprehensive treatment strategy for managing epilepsy.

1. Background

Epilepsy effects many areas of function; education, employment, family relations, recreation and social activities.[1] Persons with epilepsy also face stigma, discrimination and fear of embarrassment which all create problems for self-esteem.[2] Persons with epilepsy are also more likely to be economically disadvantaged.[3–5] To identify differential needs in health care, it is imperative to identify conditions that disproportionately affect socio-economically deprived people. In the U.S., state-based programs typically focus on the most prevalent conditions such as cancer, diabetes and cardiovascular disease. However, a recent publication by the Centers for Disease Control (CDC) has acknowledged the importance of less prevalent conditions, such as epilepsy.[6] Objectives of the U.S. government's report *Healthy People 2010* include increasing both the quality and years of healthy life and to eliminate health disparities.[7] The limited knowledge between epilepsy and low socioeconomic status has been highlighted at two U.S. conferences held in conjunction with Centers for Disease Control in 1995 and 2003.[8]

In a recent examination of the 2001–2004 National Health Interview Survey (n = 123,610) the prevalence of serious psychological distress was higher in females, those with less than a high school diploma and those in poverty. Persons with serious psychological distress were less likely to be married, more likely to be obese, more likely to be current smokers and more likely to have a history of heart disease, diabetes, arthritis and stroke than persons without serious psychological distress.[9] Persons with epilepsy report significantly higher rates of these same issues.[10–15]

Persons with epilepsy are at higher risk for developing mood disorders than the general population.[16] Moreover, the incidence of depression in epilepsy is higher than that of other chronic health conditions, such as asthma.[17] Anxiety also has a significant impact on health-related quality of life (HRQOL) and is commonly comorbid with epilepsy.[18,19] The under-recognition and under-treatment of mood disorders in persons with epilepsy is likely due to the rather atypical presentation of symptoms.[20] Kanner et al. found 71% of epilepsy patients with depression failed to meet DSM-IV criteria, but complained of anhedonia, fatigue, anxiety, irritability, frustration, crying and mood lability.[21]

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Treatment strategies that focus solely on seizure reduction are inadequate and unsuccessful for up to one half of patients with epilepsy.[2] In one investigation psychological distress, loneliness, adjustment and coping, and stigma perception were the most significant predictors of self-rated HRQOL. When psychosocial and clinical variables were examined in combination none of the clinical variables (onset, seizure frequency, side effects of antiepileptic drugs (AEDs)) contributed significantly to patients' HRQOL judgement.[22] In another study seizure severity, seizure frequency, antiepileptic drug polytherapy and duration of epilepsy were not substantially associated with depression or anxiety when regressed against Beck Depression Inventory (BDI) scores, or the Symptom Checklist-90 for anxiety and depression in persons with temporal lobe epilepsy.[23] This suggests that anxiety and depression exert independent, adverse effects on HRQOL.

Issues related to poverty and serious psychological distress have not been studied in epilepsy. The goal of this study was to examine the prevalence of self-reported serious psychological distress and poor health-related quality of life in persons with a history of epilepsy (PWHE) in poverty. The axiom of "treating the whole patient" requires examining the relationship between poverty, serious psychological distress and poor HRQOL. It is theorized that persons with both epilepsy and poverty are likely to suffer more due to the combination of these problems than people suffering from either one (or none) of these problems alone. Such research may provide healthcare practitioners and state-based epilepsy advocacy organizations better information to coordinate care.

2. Methods

The California Health Interview Survey (CHIS) is a geographically stratified, random-digit dialed, two-stage telephone survey conducted on a biennial state-basis of non-institutionalized persons in California, over the age of 18. CHIS data have been used to address many chronic health problems[24–28] and risk factors, such as obesity[29] and smoking.[30] The CHIS is conducted by the Center for Health Policy Research at the University of California at Los Angeles (UCLA) and is the largest state-based health survey in the United States. A full description of the topics, questionnaires, survey methodology and sample design are described on the CHIS website hosted by the UCLA Center for Health Policy at http://www.askchis.org/methods_main.html. The household response rate was 29.5% for the 2005 CHIS. This is comparable to response rates from the 2005 California Behavioral Risk Factor Surveillance System (BRFSS) Survey of 29.2%. The 2005 data and codebooks were obtained through the CHIS website. The Ohio State University Institutional Review Board deemed the research exempt prior to analyses being completed.

To assess lifetime epilepsy prevalence (history of epilepsy), we used the question "Have you ever been told by a doctor that you have a seizure disorder or epilepsy?" Demographics (gender, age, race/ethnicity, marital status, educational attainment and employment status), serious psychological distress, as defined by the Kessler 6 (K6), and HRQOL were analyzed. Poverty was defined in the CHIS by reported annual income levels, total household size and number of children. In 2005, <200% Federal Poverty Level (FPL) was defined by the U.S. government as $38,700 for a family of four.[31]

The U.S. Department of Health and Human Services poverty guidelines (or various percentage multiples of them) are used as eligibility criteria for means-tested federal programs (eligibility for benefits is determined by property or wealth). These include the Low Income-Home Energy Assistance Program, Community Food and Nutrition Program, Job Opportunities for Low-Income Individuals and the subsidized portion of the Medicare Prescription Drug Program. However, some means tested programs do not use poverty guidelines such as Supplemental Security Income, Earned Income Tax Credit, Medicaid and low-rent public housing. Since there is no standard definition of income for all program eligibility purposes, we defined poverty status as <200% Federal Poverty Level in order to include individuals who may fall on the cusp for public assistance eligibility (i.e., State Children's Health Insurance Program).

An extensive number of tools exist in the literature to assess mental health,[32] however, most are too long to be administered in large epidemiological studies designed to study multiple health conditions.[9] The K6 is a brief epidemiological screening tool developed to identify persons with a high likelihood of having diagnosable psychological distress severe enough to cause moderate to serious impairment in social, occupational or school functioning using the least amount of questions as possible. A score $\geq$13 is used to indicate serious psychological distress with a range of scores from 0 to 24.[9] This is the optimal cut point which equalizes false-positive and false-negative results. The K6 was found to be the most efficient screening tool with a sensitivity of 0.36 and a specificity of 0.96, and total classification accuracy of 0.96 as compared with other instruments such as the World Health Organization's Disability Assessment Schedule.[33]

HRQOL measures used in the CHIS are based on a set of healthy days assessments (general, physical and mental) as well as normal activity limitation days that were developed and validated by the CDC. These questions are often used in surveys, surveillance systems and population level prevention research.[34] Despite their brevity these questions have construct validity[35] and criterion validity in both healthy and disabled populations,[36–38] as well as excellent retest reliability.[39]

3. Data analysis

All analyses were conducted with Stata Version 9.2 (Stata Corp. LP, College Station, TX) using replicate weights to achieve corrected variance estimates.[40,41] Data were weighted to obtain appropriate estimates, standard errors and confidence intervals. Replicate weights are a series of weight variables that contain the information necessary for correctly computing (via the replicate weight method) the standard errors of point estimates when analyzing survey data. Weighting procedures compensate for differential probabilities of selection to reduce bias that may occur. Weighting also adjusts for undercoverage to reduce the variance of the estimates by using auxiliary information. An adult final weight was created for each adult who completed the adult extended interview. The initial adult weight is the product of the final household weight and the reciprocal of the probability of selecting the adult from all adults in the household. In subsequent steps, the initial adult weight is adjusted for non-response and raked (a multidimensional post-stratification procedure) to known control totals. To compensate for undercoverage of adults that could not be interviewed because they reside in households without a landline telephone, the raking adjustment included a dimension designed to reduce the undercoverage bias.

Four populations are presented in the analyses: (1) PWHE <200% FPL, (2) PWHE $\geq$200% FPL, (3) those not reporting a history of epilepsy <200% FPL and (4) those not reporting a history of epilepsy $\geq$200% FPL. Both numerical counts and percentages were reported for each population. Comparisons across populations were made using PWHE in poverty as the reference group. To adjust for the multiple comparisons in statistical testing, a Bonferroni correction was used. With an overall type I error at 0.05, an $\alpha = 0.0167$ was used for each individual two-group comparison. Both percents and 98.33% confidence intervals are provided in reporting population level prevalence estimates. Results are considered significantly different and marked with asterisks in the tables when the 98.33% confidence intervals do not overlap.

To examine the effect of poverty on HRQOL in PWHE, analyses were conducted using self-rated health status, number of general, physical and mental unhealthy days in the past 30 days and normal activity limitation days in the past 30 days as the dependent variables. Logistic regression was performed for self-rated health status, which was recoded as fair or poor health vs. excellent, very good or good health. Based on a frequency distribution graph, reported unhealthy days were not normally distributed. Logistic regressions were also performed with reported unhealthy days being recoded into two categories: $<14 = 0$ and $\geq 14 = 1$. A similar strategy has been used with data from the Behavioral Risk Factor Surveillance System (BRFSS),[42] an ongoing state-based, random-digit dialed telephone survey of non-institutionalized persons in the U.S., over the age of 18 that also tracks the prevalence of key health behaviors and characteristics. The BRFSS is conducted by all 50 state departments of health in the United States through support from the CDC.

Results are presented as odds ratios between history of epilepsy and non-epilepsy. Adjustments for demographics (gender, age, race/ethnicity, annual household income, educational attainment and urban or rural residence) are presented first (Adjusted1 model). The Adjusted2 model controls for demographics and comorbid health conditions (asthma, obesity, type 2 diabetes, high blood pressure, heart disease, stroke, high cholesterol and cancer). Significant results in are noted with asterisks.

4. Results

4.1. Demographic characteristics

Forty-one percent of PWHE (246/604) were determined to be <200% FPL (in poverty), yielding an adjusted lifetime prevalence rate 0.5% [98.33% CI 0.4–0.7], see Table 1. PWHE in poverty were significantly more likely to be non-Caucasian and less likely to have earned a college degree when compared to the two populations ≥200% FPL (not in poverty). PWHE in poverty were significantly more likely to report being unemployed (and not looking for work) than the other three populations. PWHE in poverty were also significantly more likely to report disability due to physical, mental or emotional problems than the two non-epilepsy populations.

4.2. Access to mental health services

There were no differences in mental health access between the two populations of PWHE, see Table 2. However, PWHE in poverty reported they needed help for emotional or mental health in the past 12 months at rates twice that of the non-epilepsy populations. PWHE in poverty also reported having insurance coverage for mental health treatment twice that of the non-epilepsy populations.

4.3. Kessler 6 serious psychological distress

PWHE in poverty reported feeling depressed, feeling worthless and that everything is an effort in the past 30 days significantly more than the other three populations, see Table 2. They also reported feeling nervous and restless more than the two non-epilepsy populations. Feelings of hopelessness were significantly higher for PWHE in poverty compared to the two populations not in poverty. PWHE in poverty reported significantly higher amounts of serious psychological distress based on the K6 composite score than both non-epilepsy populations. There was no difference in rates of reported serious psychological distress between the two epilepsy populations.

Table 1
Participant demographic characteristics by epilepsy history for the 2005 California Health Interview Survey.

Variable	Ever told had epilepsy/seizure disorder		Non-epilepsy population	
	<200% FPL	≥200% FPL	<200% FPL	≥200% FPL
	% (*N*) [98.33% CI]	% (*N*) [98.33% CI]	% (*N*) [98.33% CI]	% (*N*) [98.33% CI]
Total	0.5 (246) [0.4–0.7]	0.8 (358) [0.6–1.0]	30.9 (11,007) [30.3–31.5]	67.8 (31,409) [67.2–68.4]
Gender				
Male	42.5 (81) [29.7–56.4]	47.6 (130) [38.2–57.2]	44.8 (3812) [43.5–46.2]	51.1 (13,449) [50.6–51.7]
Female	57.5 (165) [43.6–70.3]	52.4 (228) [42.8–61.8]	55.2 (7195) [53.8–56.5]	48.9 (17,960) [48.3–49.5]
Age				
18–34	33.7 (52) [21.6–48.4]	30.9 (57) [21.7–41.9]	40.6 (3007) [39.3–41.9]	29.0 (5006) [28.3–29.7]
35–44	27.3 (50) [17.0–40.9]	22.2 (69) [16.0–30.1]	21.0 (2072) [20.0–22.1]	22.1 (6137) [21.5–22.6]
45–64	28.4 (103) [19.8–38.9]	39.6 (184) [32.2–47.4]	22.4 (3159) [21.5–23.5]	34.8 (13,291) [34.3–35.3]
65+	10.6 (41) [5.8–18.7]	7.3 (48) [4.7–11.0]	16.0 (2769) [15.3–16.7]	14.2 (6975) [13.9–14.5]
Race/ethnicity				
White	49.4 (168) [37.7–61.3]	74.8 (297) [64.6–82.9][a]	42.3 (6283) [40.8–43.9]	68.7 (25,023) [68.0–69.5][a]
Non-white or Hispanic	50.6 (78) [38.7–62.3]	25.2 (61) [17.1–35.4][a]	57.7 (4724) [56.2–59.2]	31.3 (6386) [30.6–32.0][a]
Marital status				
Married	29.7 (60) [18.7–43.8]	51.9 (175) [43.0–60.7]	44.3 (4151) [42.6–45.9]	60.4 (18,385) [59.6–61.3][a]
Wid/sep/div/unmarried couple	33.2 (116) [23.8–44.1]	25.4 (114) [18.4–33.9]	30.7 (4646) [29.4–32.1]	19.8 (8715) [19.2–20.5][a]
Never married	37.1 (70) [24.7–51.6]	22.7 (69) [16.2–30.9]	25.0 (2210) [23.5–26.5]	19.8 (4309) [19.1–20.5][a]
Education				
<High school	29.7 (57) [20.1–41.5]	8.1 (21) [4.2–15.3][a]	39.7 (3312) [38.7–40.7]	6.0 (1241) [5.5–6.5][a]
High school	30.0 (79) [20.6–41.5]	22.8 (69) [15.5–32.2]	30.7 (3518) [29.5–31.9]	24.5 (6296) [23.9–25.0]
Some college/vocational school	27.4 (61) [16.6–41.8]	20.8 (77) [13.5–30.4]	15.3 (2077) [14.1–16.6]	18.4 (2077) [17.6–19.1]
AA/AS/BA/BS/graduate degree	12.9 (49) [7.5–21.2]	48.3 (191) [38.5–58.3][a]	14.4 (2100) [13.5–15.3]	51.2 (2100) [50.4–52.0][a]
Employment status				
Employed, full–time	28.2 (48) [17.5–42.2]	61.0 (193) [51.9–69.4][a]	48.9 (4304) [47.1–50.6][a]	65.8 (18,696) [65.0–66.7][a]
Employed, part-time	7.1 (20) [3.1–15.2]	7.9 (33) [4.5–13.5]	8.2 (1017) [7.3–9.2]	7.9 (1017) [7.4–8.3]
Unemployed	64.7 (178) [51.2–76.2]	31.6 (132) [23.7–39.5][a]	42.9 (5686) [41.4–44.5][a]	26.3 (10,207) [25.5–27.1][a]
Disability status due to physical/ mental/emotional problems	64.2 (190) [50.7–75.8]	43.4 (181) [34.0–53.4]	38.1 (5108) [36.3–40.0][a]	25.5 (8924) [24.6–26.4][a]

[a]Where the 98.33% CI do not overlap with the reference group defined as persons with epilepsy <200% Federal Poverty Level (FPL).

Table 2
Mental health access and Kessler 6 psychological distress characteristics of participants by epilepsy history for the 2005 California Health Interview Survey.

Variable	Ever told had epilepsy/seizure disorder		Non-epilepsy population	
	<200 FPL % (*N*) [98.33% CI]	≥200 FPL % (*N*) [98.33% CI]	<200 FPL % (*N*) [98.33% CI]	≥200 FPL % (*N*) [98.33% CI]
Needed help for emotional or mental health problem in past 12 months	43.2 (114) [31.9–55.4]	25.0 (100) [17.4–34.5]	22.7 (2660) [21.3–24.2][a]	16.3 (5288) [15.5–17.2][a]
Insurance covers mental health treatment	29.0 (89) [19.9–40.3]	24.2 (101) [17.1–33.1]	11.3 (1611) [10.3–12.3][a]	14.6 (4910) [13.8–15.4][a]
Kessler 6 scale				
Feel depressed in the past 30 days				
All or most of the time	15.4 (32) [9.1–24.8]	4.3 (19) [2.0–8.8][a]	4.9 (577) [4.3–5.7][a]	1.2 (336) [1.0–1.4][a]
Some, a little of the time or not at all	84.7 (210) [75.3–90.9]	95.8 (335) [91.2–98.0][a]	95.1 (10,393) [94.3–95.8][a]	98.8 (30,977) [98.6–99.0][a]
Feel worthless in the past 30 days				
All or most of the time	14.1 (35) [7.9–23.8]	3.0 (18) [1.3–6.9][a]	4.5 (612) [3.9–5.2][a]	1.2 (373) [1.0–1.4][a]
Some, a little of the time or not at all	85.9 (207) [76.2–92.1]	97.0 (336) [93.1–98.7][a]	95.5 (10,358) [94.8–96.1][a]	98.8 (30,940) [98.6–99.1][a]
Feel everything is an effort in the past 30 days				
All or most of the time	32.9 (75) [21.0–47.6]	13.0 (55) [7.9–20.6][a]	13.0 (1576) [11.9–14.2][a]	6.4 (1805) [5.9–6.9][a]
Some, a little of the time or not at all	67.1 (167) [52.4–79.0]	87.0 (299) [79.4–92.1][a]	87.0 (9394) [85.8–88.1][a]	93.6 (29,508) [93.1–94.1][a]
Feel nervous in the past 30 days				
All or most of the time	21.7 (58) [13.7–32.5]	9.5 (40) [5.2–16.7]	9.2 (1133) [8.3–10.2][a]	4.1 (1138) [3.8–4.5][a]
Some, a little of the time or not at all	78.3 (184) [67.5–86.3]	90.6 (314) [93.3–94.8][a]	90.8 (9837) [89.8–91.7][a]	95.9 (30,175) [95.6–96.2][a]
Feel restless in the past 30 days				
All or most of the time	19.4 (49) [11.5–30.9]	12.6 (42) [7.4–20.5]	9.3 (1149) [8.2–10.4][a]	5.1 (1420) [4.6–5.5][a]
Some, a little of the time or not at all	80.6 (193) [69.1–88.6]	87.4 (312) [79.5–92.6]	90.7 (9821) [89.6–91.8][a]	95.0 (29,893) [94.5–95.4][a]
Feel hopeless in the past 30 days				
All or most of the time	9.6 (27) [5.3–16.9]	1.9 (14) [0.7–4.9][a]	5.6 (660) [4.9–6.4]	1.4 (416) [1.2–1.7][a]
Some, a little of the time or not at all	90.4 (215) [83.1–94.7]	98.1 (340) [95.1–99.3][a]	94.4 (10,310) [93.6–95.1]	98.6 (30,897) [98.3–98.8][a]
K6 defined serious psychological distress	17.9 (50) [11.4–26.9]	5.9 (33) [2.9–11.9]	7.2 (943) [6.5–8.1][a]	2.1 (632) [1.8–2.5][a]

[a]Where the 98.33% CI do not overlap with the reference group defined as persons with epilepsy <200% Federal Poverty Level (FPL).

4.4. Health-related quality of life

After adjusting for demographics (gender, age, race/ethnicity, income, education and residence) and other comorbid conditions (asthma, obesity, type 2 diabetes, hypertension, heart disease, stroke, high cholesterol and cancer), logistic regression analyses reveal PWHE in poverty were significantly more likely to report fair or poor self-rated health status than the other three populations, see Table 3. PWHE in poverty were also more likely to report ≥14 generally unhealthy days and ≥14 physically unhealthy days in the past 30 days than the other three populations. No differences were found between the two epilepsy populations for mentally unhealthy days and normal activity limitation days.

5. Discussion

5.1. Demographics

A larger number of PWHE are in poverty when compared to the non-epilepsy population (41% vs. 31%). PWHE in poverty do not appear to have a greater educational disparity compared to their non-epilepsy counterparts in poverty. This suggests that poverty, not epilepsy, may be the more significant barrier to educational attainment. PWHE in poverty are more likely to be disabled due to physical, mental or emotional problems which suggest that the non-epilepsy population in poverty are more likely to be working but still in poverty. Persons with epilepsy are known to experience greater difficulties in obtaining and maintaining employment[43,44] which may explain the higher rates of disability. Home-based employment opportunities have been suggested.[45] Unfortunately, for individuals with limited education such opportunities are limited.

5.2. Access to mental health services

PWHE in poverty reported accessing mental health services more than the two non-epilepsy populations. This may be due to a greater need for psychological care for persons with epilepsy in general. By seeking psychological services, it is logical that PWHE would access covered mental health services at higher rates. This may have also impacted how respondents answered the K6 questions. Persons receiving pharmacotherapy and/or psychological counseling treatment may have had either partial or full remission of their symptoms. In either case this suggests the findings are potentially underestimates.

5.3. Kessler 6 serious psychological distress

PWHE in poverty had more psychological distress than the two non-epilepsy populations. Our findings support previous population surveys demonstrating that persons with serious psychological distress are more likely to have less education and be living in poverty.[9] PWHE in poverty were significantly more likely to report depression, feeling everything is an effort and having feelings of worthlessness in the past 30 days than the other three populations. But no differences were found between the two epilepsy populations in serious psychological distress and two questions on the K6 (nervous and restless). Ours findings suggest that feelings of anxiety are common among persons with epilepsy regardless of their poverty status. This could be explained by the nature of epilepsy as a chronic disease with episodic attacks (seizures). Our findings suggest that persons in poverty experience feelings of hopelessness regardless of epilepsy status.

Since the CHIS is population based, it is less likely to have sampling biases associated with surveying only persons with more chronic epilepsy seen primarily at tertiary centers. Studies

Table 3
Logistic regression for health-related quality of life characteristics of participants by epilepsy history for the 2005 California Health Interview Survey.

Variable	Ever told had epilepsy/seizure disorder		Non-epilepsy population	
	<200% FPL	≥200% FPL	<200% FPL	≥200% FPL
	Odds ratio (95% CI)	Odds ratio (95% CI)	Odds ratio (95% CI)	Odds ratio (95% CI)
Self-rated health				
Fair or poor vs. excellent/very good/good				
Adjusted1	1.00 (reference)	0.42 (0.31–0.56)**	0.28 (0.23–0.35)**	0.21 (0.17–0.25)**
Adjusted2	1.00 (reference)	0.41 (0.32–0.51)**	0.32 (0.26–0.39)**	0.23 (0.19–0.27)**
Unhealthy days in the past 1 month <14 days vs. ≥14 days				
General unhealthy days				
Adjusted1	1.00 (reference)	0.77 (0.61–0.97)*	0.42 (0.33–0.54)**	0.40 (0.31–0.51)**
Adjusted2	1.00 (reference)	0.78 (0.62–0.98)*	0.48 (0.39–0.58)**	0.45 (0.37–0.54)**
Physically unhealthy days				
Adjusted1	1.00 (reference)	0.67 (0.50–0.90)**	0.33 (0.25–0.44)**	0.29 (0.22–0.37)**
Adjusted2	1.00 (reference)	0.69 (0.56–0.84)**	0.38 (0.31–0.48)**	0.33 (0.26–0.41)**
Mentally unhealthy days				
Adjusted1	1.00 (reference)	1.07 (0.87–1.32)	0.58 (0.48–0.71)**	0.52 (0.42–0.64)**
Adjusted2	1.00 (reference)	1.11 (0.86–1.45)	0.66 (0.53–0.81)**	0.58 (0.46–0.72)**
Normal activity limitation days				
Adjusted1	1.00 (reference)	1.09 (0.85–1.39)	0.42 (0.31–0.56)**	0.37 (0.27–0.50)**
Adjusted2	1.00 (reference)	1.16 (0.81–1.65)	0.50 (0.36–0.69)**	0.44 (0.31–0.61)**

Notes: The Adjusted1 model adjusts for the follow demographics: gender, age, race/ethnicity, annual household income, educational attainment and urban or rural residence. The Adjusted2 model adjusts for the demographics from Adjusted1 model and for co-morbid health conditions: asthma, obesity, type 2 diabetes, high blood pressure, heart disease, stroke, high cholesterol and cancer.

* $p \leq .05$.

** $p \leq .001$.

estimate the prevalence of depression in persons with epilepsy in tertiary care centers to be as high as 43–54%.[46,47] Other population surveys using similar methodology found persons with a history of epilepsy were more likely to report lifetime anxiety (OR 2.4) and suicidal thoughts (OR 2.2) than persons without epilepsy.[48] Persons with self-reported epilepsy were twice as likely to report depression or anxiety, after controlling for demographic characteristics in the 2004 Healthstyles Survey of 4345 adults ≥age 18.[49]

5.4. Health-related quality of life

When comorbid conditions are controlled for such as asthma, obesity, type 2 diabetes, high blood pressure, high cholesterol, heart disease, stroke and cancer, PWHE in poverty still have significantly poorer self-rated health status compared to the other three populations. The odds ratios indicate a progressive trend of better self-rated health across the four populations. Global ratings of self-rated health status were found to be an independent predictor of mortality in 27 community-based studies, despite numerous health status indicators and other covariates that predict mortality.[50]

PWHE in poverty were significantly more likely to report ≥14 days of poor general health and ≥14 days of poor physical health in the past 30 days than the other three populations. Previous population studies in California, Ohio, South Carolina and Texas using data from the BRFSS found persons with a history of epilepsy have greater unhealthy days compared to those without epilepsy.[11,12,51,52] These studies used different methodology (linear regression) and based on a frequency distribution, were not appropriate for the 2005 CHIS data so direct comparisons cannot be made.

Studies in epilepsy typically control for income and overlook the relationship between low socioeconomic status and poor health. Persons with epilepsy <200% FPL, compared to the non-epilepsy population (41% vs. 31%), have significant barriers to optimal treatment outcomes especially when healthcare practitioners fail to recognize bio-psycho-social factors. The Centers for Disease Control is giving greater attention towards epilepsy. Prospective surveys and funding for outreach programs are needed to enhance health policy for persons with epilepsy. Overall, these data suggest the combination of poverty and epilepsy contributes more to certain aspects of poor mental health. Nevertheless, practitioners would be justified in routinely screening all patients with epilepsy for evidence of depression or anxiety since many are under-diagnosed and under-treated based on current diagnostic criteria.[16] Various instruments are available for screening including the Beck Depression Inventory, the Hamilton Rating Scale (HAM-D) and the Neurological Disorders Depression Inventory for Epilepsy (NDDI-E) recently developed by Gilliam et al.[53]

Patients with evidence of serious psychological distress should be treated appropriately, including the use of antidepressant medications and cognitive behavioral therapy (CBT) when either or both are appropriate. Recent studies suggest citalopram, sertraline and fluoxetine are safe for persons with epilepsy.[21,54,55] Research addressing appropriate psychological interventions in the epilepsy population are needed.[56–58] Although the literature is limited for epilepsy populations, recent evidence suggests that CBT might have better long-term success than antidepressants.[59]

5.5. Limitations

The CHIS has limitations. Homes without telephones or individuals with cell phones were excluded from the survey. The CHIS excludes those in the military and institutionalized individuals such as those who live in group homes, nursing homes or prisons as well as the homeless. These factors may limit elderly respondents or those with chronic epilepsy and mental illnesses. In order to avoid health estimate biases for elderly persons, the CHIS includes proxy interviews for frail and ill persons over the age of 65 who were unable to complete the extended adult interview. People with severe impairments were excluded due to functional capacity required for participation. Since these excluded groups of individuals may in fact have

worse epilepsy, our findings may underestimate the impact of comorbid conditions on HRQOL.

The CHIS is a cross-sectional study and this limits its ability to assess causal or temporal relationships between epilepsy and health behaviors or conditions. This was a population-based study but only a small number of participants report having epilepsy. We chose to limit subgroup analysis and only analyze the data by lifetime prevalence. Self-report of epilepsy by participants is also limited since no confirmation is made by health professionals. Respondents may over or under report their seizure frequency or epilepsy. Feelings of stigma may also limit self-report of epilepsy. Persons may also report non-epileptic spells as epilepsy. Acute symptomatic seizures may also be mistakenly reported by participants.

The K6 is a screening tool and does not provide clinical information on which specific psychiatric diagnosis or diagnoses a person may have. It does not provide an estimate of the prevalence of any specific mental illnesses as defined by ICD-9 or DSM-IVTR criteria. The low sensitivity combined with a high specificity for the K6 suggests it may only detect the most severe cases of serious psychological distress. This could explain why the measures of poor HRQOL were independent of serious psychological distress. Despite all the limitations, large epidemiological studies such as the CHIS are a useful source of preliminary research. Since the CHIS is population based, it is theoretically more reflective of epilepsy in general population and therefore less likely to be a biased reflection of those only treated in tertiary centers which are the subject of many investigations.

6. Conclusions

The epilepsy population at highest risk for health disparities are persons living in poverty. This study provides an estimate of the magnitude of serious psychological distress in PWHE as well as the effects of epilepsy and poverty on HRQOL from an epidemiological perspective. PWHE in poverty have significantly higher rates of serious psychological distress and poor HRQOL of life after controlling for demographics and comorbidities. Psychological well-being needs to be incorporated into any comprehensive treatment strategy for managing epilepsy and maximizing HRQOL. Resources are needed to assist persons with epilepsy in poverty, since they are at greatest risk for poor health outcomes. In the U.S., state-level departments of health should consider supporting epilepsy self-management programs that include health promotion. Focused employment programs and enhanced public transportation programs may also improve opportunities for persons with epilepsy to bring themselves out of poverty.

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